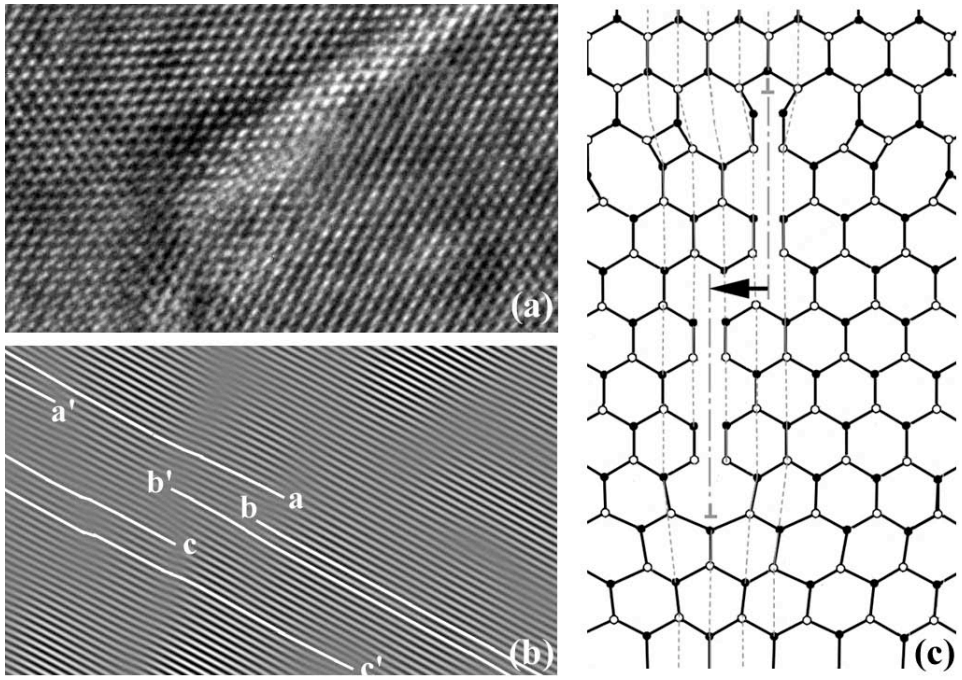
Intersecting stacking fault structures in GaN films grown on vicinal SiC substrate

Motivation: Stacking faults located on various planes and their related stair rod dislocations in GaN films affect their optical properties and hence the performance of devices. It is important to understand the microstructures of these defects and correlate them with optical properties.

Result and Significance: The origin of intersecting basal plane/prismatic stacking faults (BSF/PSF) lies in the nucleation of PSFs in the AlN buffer layer in the vicinity of I_1 steps on the SiC substrate surface. Some of these PSFs extend into the GaN film and due to local anisotropies in step flow kinetics can be forced to change orientation leaving behind a BSF in the process. SRDs with various characters form at the intersection of PSF/PSF or PSF/BSF. Such detailed knowledge of the formation mechanism and microstructure of intersecting stacking faults can help crystal growers to develop strategies to minimize their densities or eliminate them completely from the crystals as well as enable the correlation between these defects and optical properties of GaN films.



(a) HRTEM image of a intersecting region of stacking faults; (b) reconstructed FFT image of (a) with g=1-210; (c) possible core structure of dislocation pairs observed in (a)

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